

## STRATEGIES

- Dredging
- Mangrove Removal
- Sediment Forebay
- Bank Stabilization/Erosion Control
- Green Infrastructure
- Trash Management
- Community Partnerships

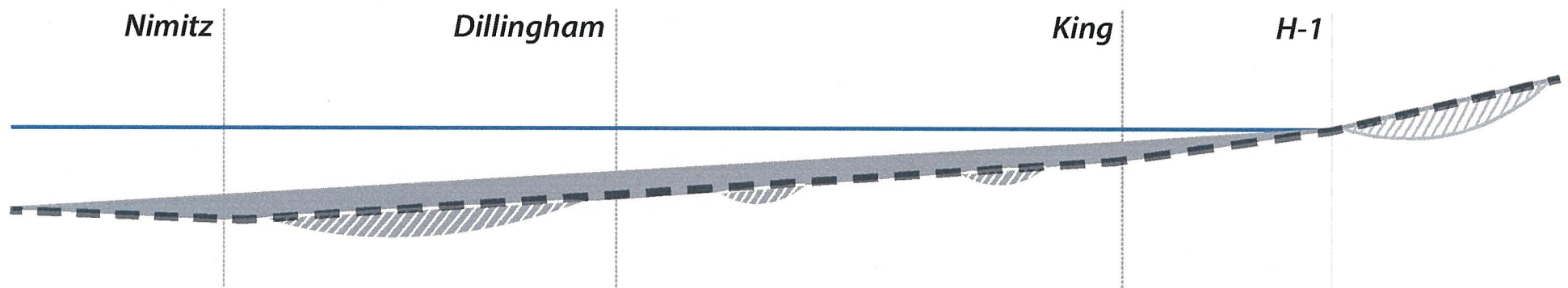
## CHALLENGES

- Sea Level Rise
- Community Partnerships

## STRATEGY: DREDGING

### Improvements in:

- Visual Quality
- Hydraulic Flow
- Flood Capacity



### Conceptual Dredging Section

- Original Canal bottom
- Dredging to original 1939 design
- ▨ Additional dredging to improve hydraulic flow and flood capacity
- ▨ Additional dredging to capture upstream sediment

## STRATEGY: MANGROVE REMOVAL

- Removal of the invasive species is known to improve water quality, potentially restoring native flora and fauna



***Photos before and after mangrove removal. Site unknown.***

Source: Facebook>Pono Pacific Lang Management LLC>Mangrove Removal Photo Album. <https://www.facebook.com/media/set/?set=a.197042353772080.49822.134164586726524&type=3>



## STRATEGY: SEDIMENT FOREBAY

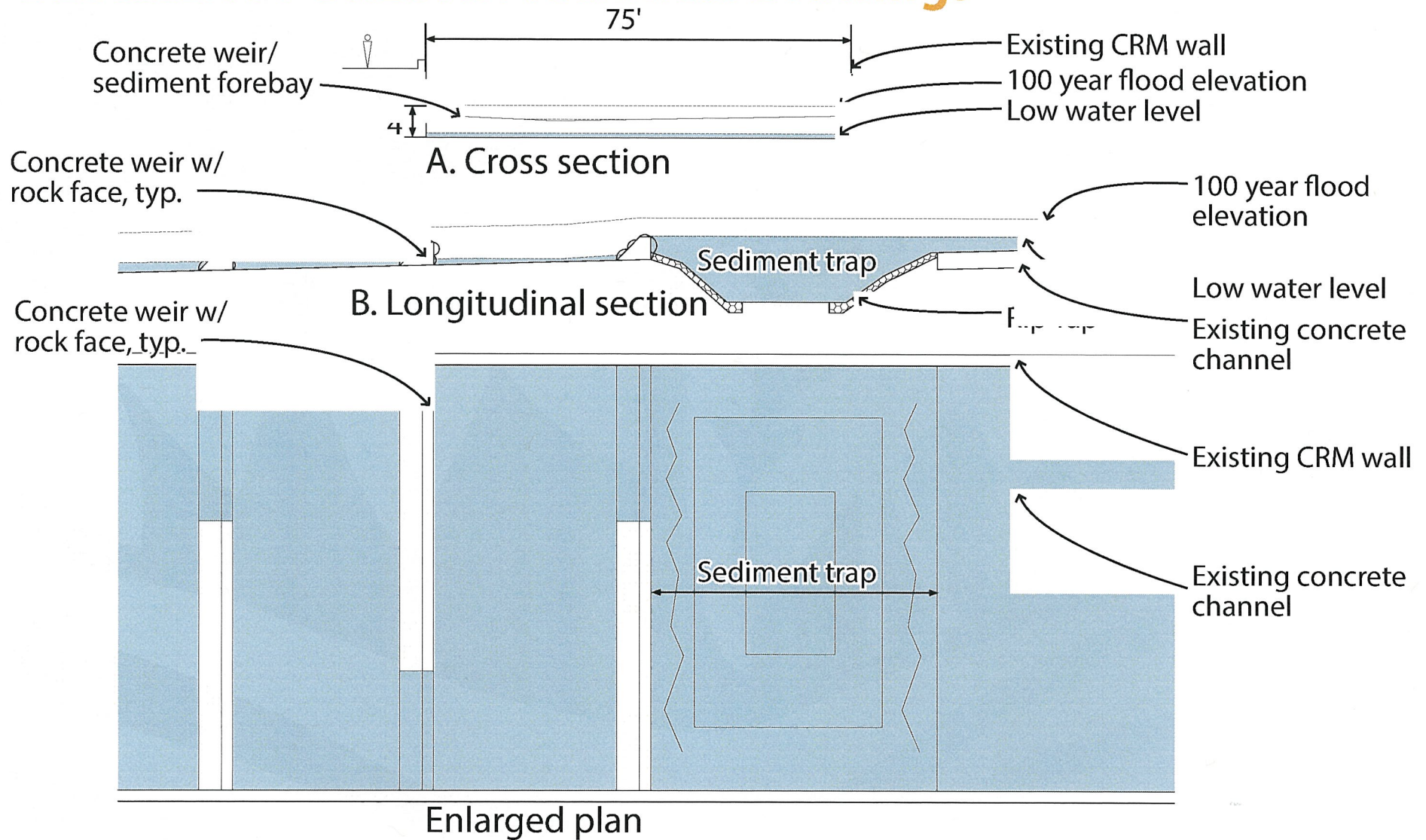
- Located at uppermost portion of project area to capture upstream sediment



*Examples of sediment forebay. Site unknown.*



# SEDIMENT FOREBAY: Technical Drawings





## STRATEGY: BANK STABILIZATION

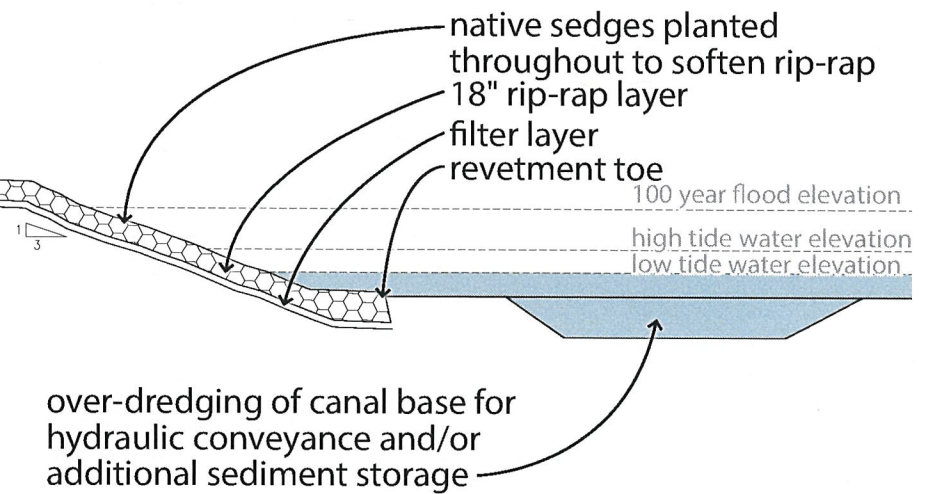
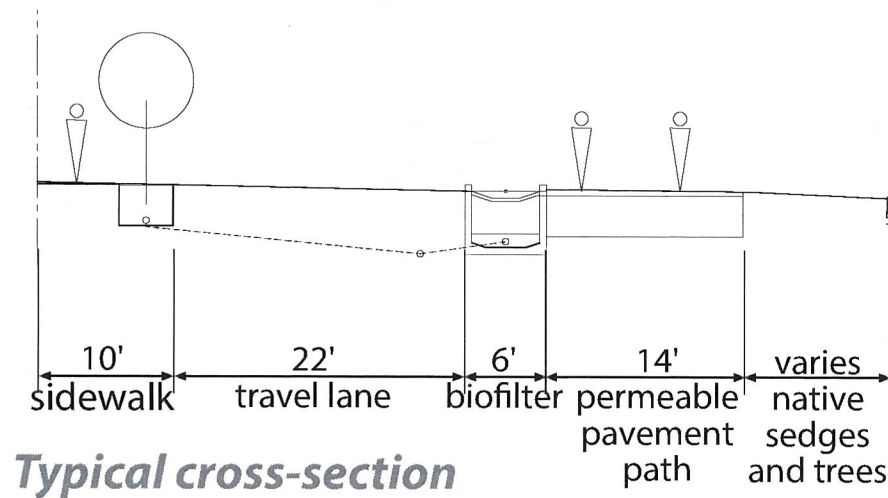
- Bank modifications to improve hydraulic flows
- Provides erosion control via native plants and rip-rap
- Opportunity to select native plants that also provide phytoremediation



***Mill River Park (Stamford, CT)***



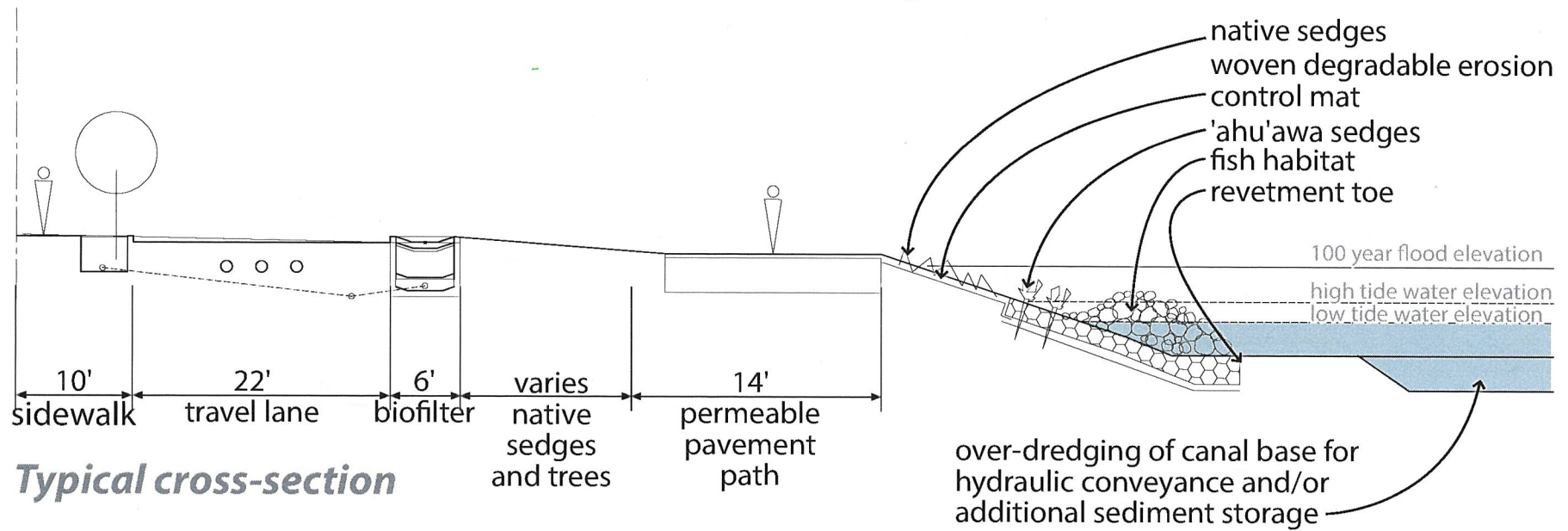
## BANK STABILIZATION: via rip-rap



**Examples of rip-rap stabilized banks**



# BANK STABILIZATION: via native plants



pohinahina



'ahu'awa



'aki'aki



'akulikuli  
(phytoremediator)



'ae'ae



pohuehue

**Native plants that provide erosion control**



## STRATEGY: Green Infrastructure

- reduces stormwater run-off and pollutants
- combination of biofilter strips and permeable pavement



***Biofilter strips at Haleiwa Store Lots***



***Permeable Pavement***

Source: Public Design Festival

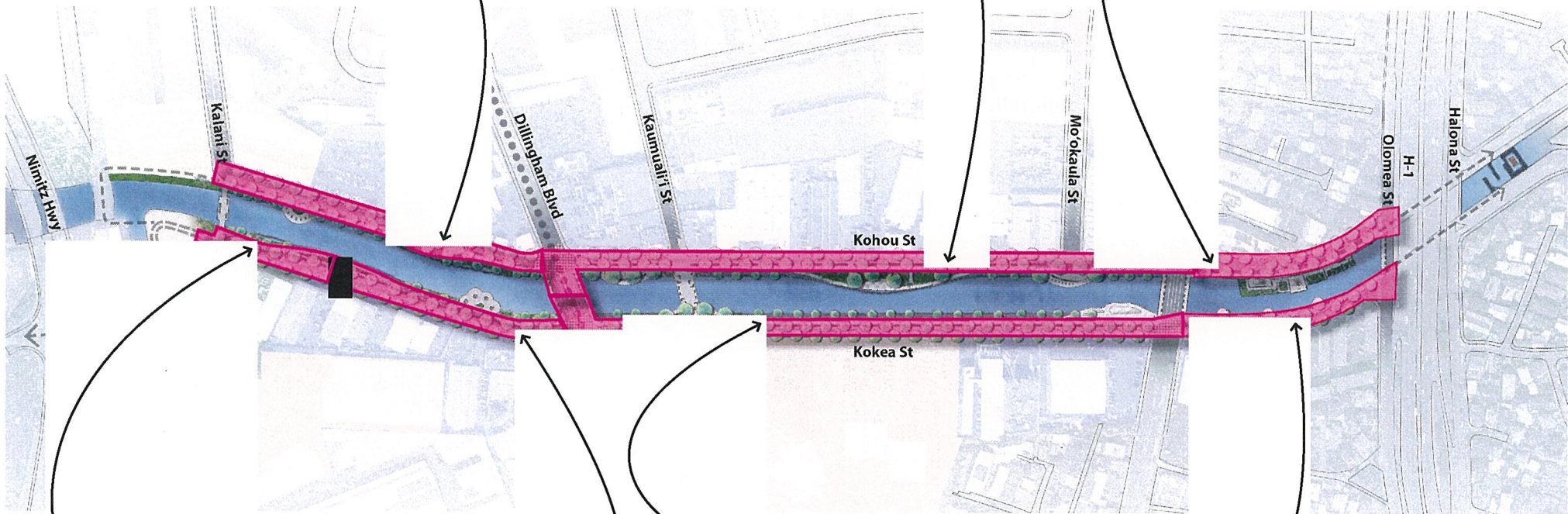


# GREEN INFRASTRUCTURE: Overall Plan

Makai-'Ewa Catchment Area: 67,000 sf  
Permeable pavement: 15,000 sf  
Vegetated Biofilter: 2,000 sf

Central-'Ewa Catchment Area: 101,000 sf  
Permeable pavement: 26,000 sf  
Vegetated Biofilter: 2,900 sf

'Ewa Catchment Area: 43,000 sf  
Permeable pavement: 8,700sf  
Vegetated Biofilter: 1,300 sf



Makai-Diamondhead Catchment Area 1: 26,000 sf  
Permeable pavement: 5,400 sf  
Vegetated Biofilter area: 770 sf

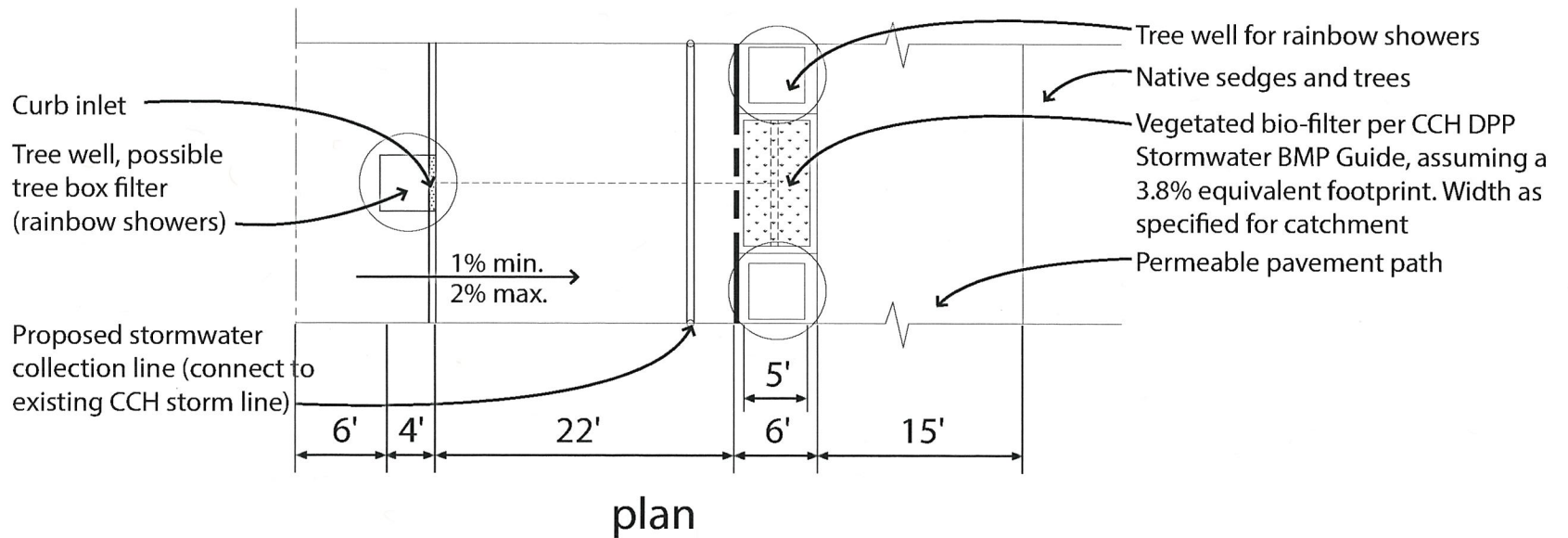
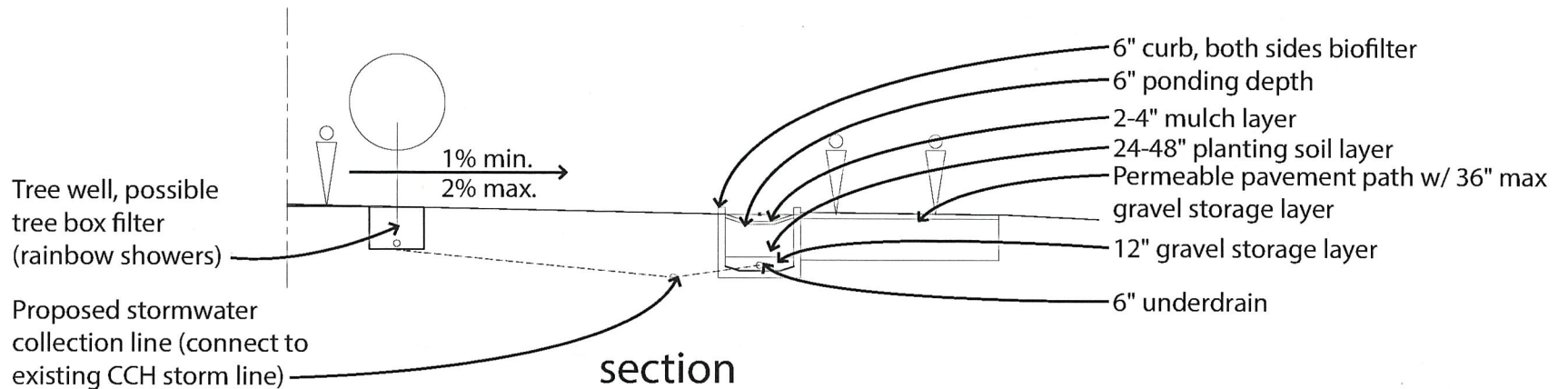
Makai-Diamondhead Catchment Area 2: 41,000 sf  
Permeable pavement area: 11,000 sf  
Vegetated biofilter area: 1,200 sf

Central-Diamondhead Catchment Area 1: 98,000 sf  
Permeable pavement: 25,000 sf  
Vegetated Biofilter area: 2,800 sf

Mauka-Diamondhead Catchment Area 1: 39,000 sf  
Permeable pavement: 8,700 sf  
Vegetated Biofilter area: 1,200 sf



# GREEN INFRASTRUCTURE: Technical Drawings



## GREEN INFRASTRUCTURE: Biofilter Plants

### TOP OF BIOFILTER

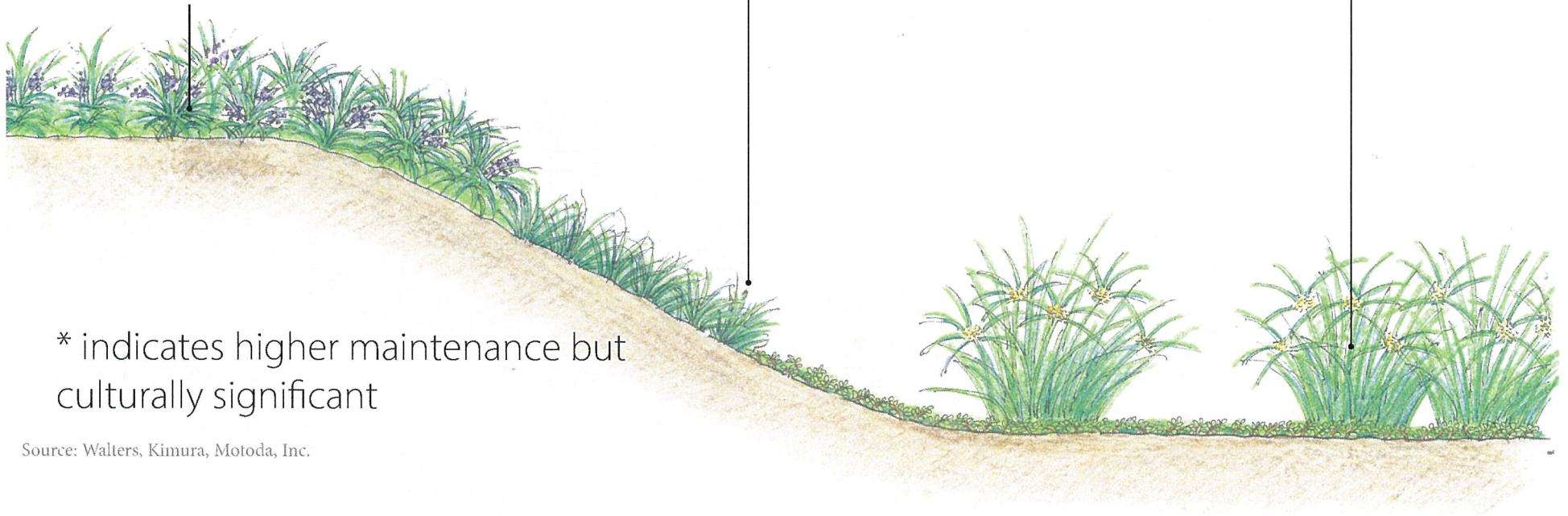
- kamani
- lonomea
- kou
- milo
- 'ulei
- pohinahina
- mau'u 'aki'aki
- carex
- 'uki'uki
- 'akia
- kawelu
- pili

### BIOFILTER SLOPE

- 'ilie'e
- carex
- pohinahina

### BOTTOM OF BIOFILTER

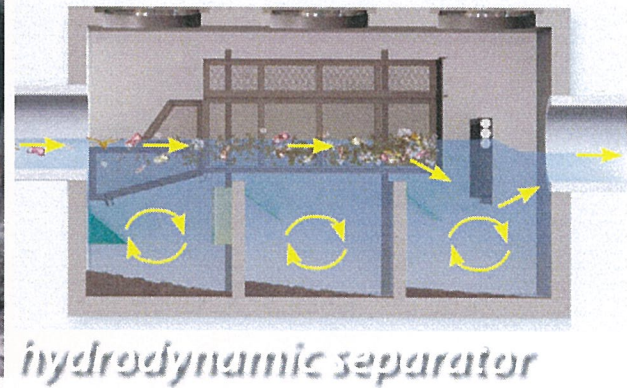
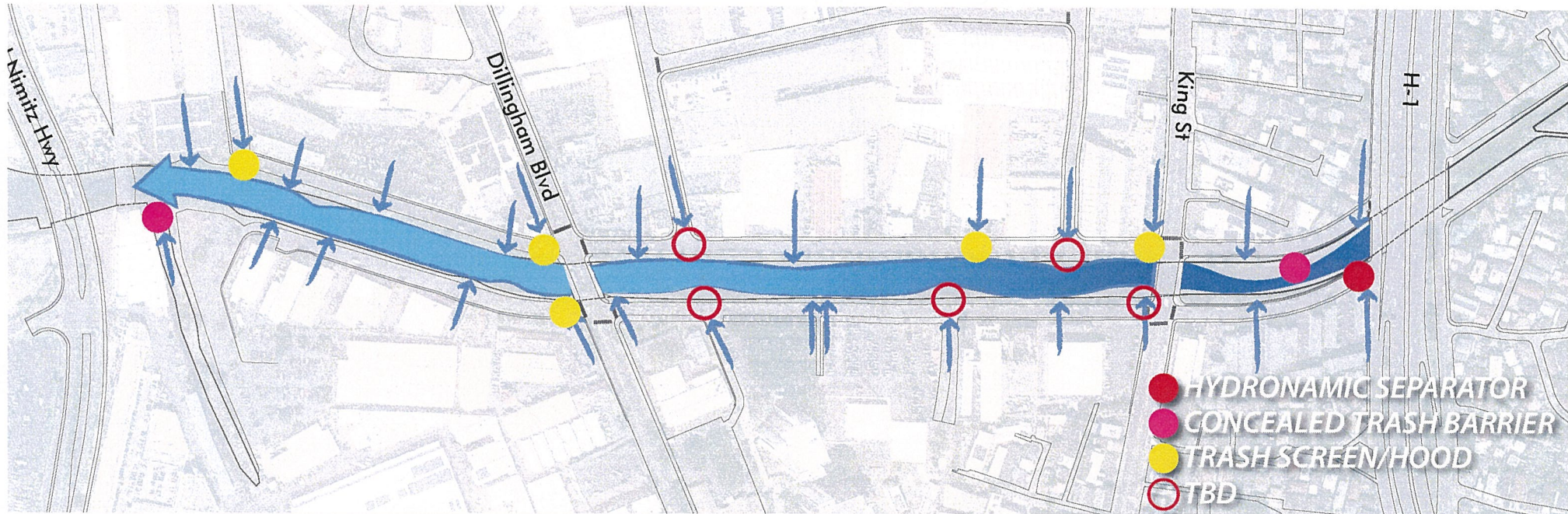
- hala
- 'ahu'awa
- 'akulikuli
- ae'ae
- kalo\*



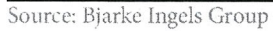
\* indicates higher maintenance but culturally significant



## STRATEGY: Trash Management

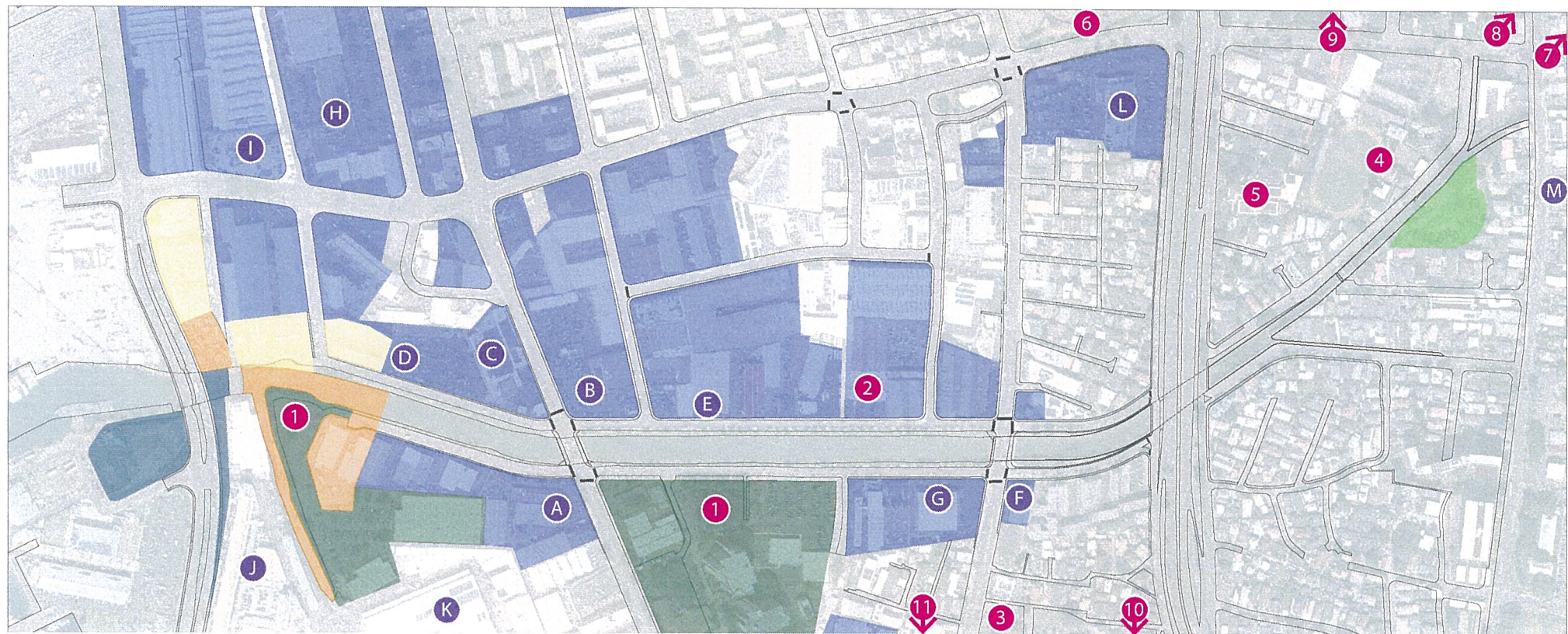








# CHALLENGE: Community Partnerships



LANDOWNERS

- STATE HARBORS
- BWS
- DHHL
- KS
- HCC
- STATE OF HAWAII

EDUCATIONAL,  
SOCIAL, AND  
CULTURAL

- 1. HCC
- 2. PAI FOUNDATION
- 3. KALIHI PĀLAMA HEALTH CENTER
- 4. DAMIEN MEMORIAL HIGH SCHOOL
- 5. QUEEN LILU'OKALANI CHILDREN'S HEALTH CENTER
- 6. FARRINGTON HIGH SCHOOL
- 7. KAMEHAMEHA SCHOOLS
- 8. KOKUA KALIHI VALLEY
- 9. BISHOP MUSEUM
- 10. PALAMA SETTLEMENT
- 11. PRINCESS KA'IULANI ELEMENTARY

COMMERCIAL

- A. KŌKEA CENTER
- B. KAPĀLAMA SHOPPING CENTER
- C. CHINATOWN MARKETPLACE
- D. CITY SQUARE CENTER
- E. SHIMAYA
- F. PĀLAMA SUPERMARKET
- G. FERGUSON
- H. FOODLAND
- I. HAWAII NEWS NOW
- J. NIMITZ CENTER
- K. BEST BUY

# **Mahalo**

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